



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US99/21341 (22) International Filing Date: 16 September 1999 (16.09.1999) (30) Priority Data: 09/154,977 17 September 1998 (17.09.1998) US (60) Parent Application or Grant AT MOBILE.COM CORPORATION [/]; (). MCNIFF, Peter, Gerald [/]; (). WILHOITE, Michael, Thomas [/]; (). TANNENBAUM, David, H. ; ().		Published
(54) Title: DATA NETWORK COMPUTING DEVICE CALL PROCESSING (54) Titre: TRAITEMENT D'APPELS POUR DISPOSITIFS INFORMATIQUES CONNECTES A UN RESEAU DE DONNEES		
(57) Abstract <p>A telecommunications service node is connected to a data network using a packet data protocol and a telephone network using a circuit switched protocol. The service node is also connected to a wireless roaming network using the IS-41 signaling protocol. The service node stores status information, including location and registration information, for mobile computing devices connected to the data packet network. The location information includes a temporary data network address for visiting mobile computing devices. The service node manages voice calls to and from the mobile computing devices. If a call is received to a mobile computing device which is not registered, the service node will attempt to connect the call to a wireless telephone associated with the mobile computing device, or a predefined destination established as a preference by the user. In the case of a voice call between a telephone connected to the telephone network and a mobile computing device connected to the data network, the service node acts as a gateway and translates between the data packet protocol and the circuit switched protocol. A personal information manager executing in a mobile computing device may be used for managing call processing functions of the mobile computing device.</p> (57) Abrégé <p>Un noeud de service de télécommunications est connecté à un réseau de données utilisant un protocole de données par paquets et à un réseau téléphonique utilisant un protocole à commutation de circuits. Ce noeud de service est également connecté à un réseau pour abonnés mobiles sans fil utilisant le protocole de signalisation IS-41. Le noeud de service mémorise des informations d'état, notamment des informations de position et d'enregistrement, relatives aux dispositifs informatiques mobiles connectés au réseau de données par paquets. L'information de position comprend une adresse temporaire de réseau de données pour les dispositifs informatiques mobiles visiteurs. Le noeud de service gère les appels vocaux entrants et sortants des dispositifs informatiques mobiles. Lorsqu'un appel est reçu par un dispositif informatique qui n'est pas enregistré, le noeud de service essaie de diriger l'appel vers un téléphone sans fil associé au dispositif informatique, ou de le diriger vers une adresse prédéfinie préférentielle choisie par l'utilisateur. Pour une communication vocale entre un téléphone connecté au réseau téléphonique et un dispositif informatique mobile connecté au réseau de données, le noeud de service agit comme une passerelle et assure la traduction entre le protocole de données par paquets et le protocole à commutation de circuits. Un manipulateur d'information personnel installé dans un dispositif informatique mobile peut être utilisé pour gérer les fonctions de traitement d'appel du dispositif informatique mobile.</p>		

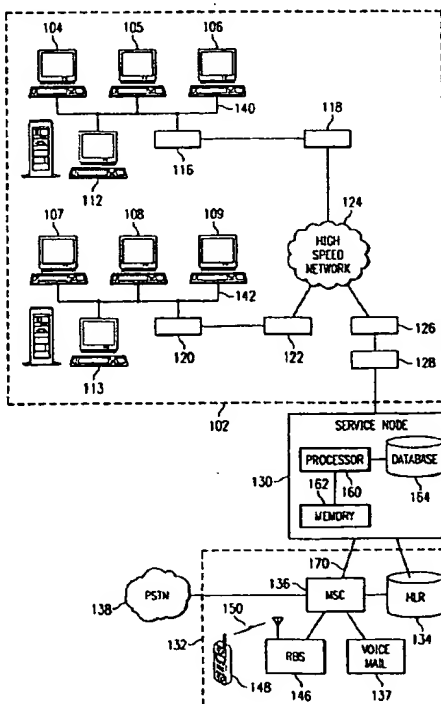


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(54) Title: DATA NETWORK COMPUTING DEVICE CALL PROCESSING**(57) Abstract**

A telecommunications service node is connected to a data network using a packet data protocol and a telephone network using a circuit switched protocol. The service node is also connected to a wireless roaming network using the IS-41 signaling protocol. The service node stores status information, including location and registration information, for mobile computing devices connected to the data packet network. The location information includes a temporary data network address for visiting mobile computing devices. The service node manages voice calls to and from the mobile computing devices. If a call is received to a mobile computing device which is not registered, the service node will attempt to connect the call to a wireless telephone associated with the mobile computing device, or a predefined destination established as a preference by the user. In the case of a voice call between a telephone connected to the telephone network and a mobile computing device connected to the data network, the service node acts as a gateway and translates between the data packet protocol and the circuit switched protocol. A personal information manager executing in a mobile computing device may be used for managing call processing functions of the mobile computing device.



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Description

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DATA NETWORK COMPUTING DEVICE CALL PROCESSING

Field of the Invention

The present invention relates generally to call processing, location management and personal feature specification / control. More particularly, the present invention relates to processing voice calls to or from computing devices connected to a data network and mobile telephones connected to a cellular voice network and how communication is managed between the networks.

Background of the Invention

Mobility is an important aspect of telecommunications services. Mobility management refers to the process of tracking and maintaining location information and status regarding a mobile communication device. For example, one of the reasons for the popularity of wireless telephones is that people who are highly mobile can still receive and place telephone calls from a single wireless telephone. Mobility management allows wireless telephones to move about within a service area while still being able to place and receive calls.

In addition to wireless telephones, mobile computing devices, such as laptop computers, palmtop computers, and personal digital assistants (PDAs), are becoming popular. Such devices are particularly useful for people who are highly mobile. These devices allow such individuals to connect to office networks while traveling. Mobility management with respect to mobile computing devices allows users of these devices to connect to data networks and to send and receive data while connected to the data networks from a location which is away from the devices home location.

One popular protocol for the exchange of information over data networks is Internet Protocol (IP). However, mobility management for such mobile computing devices presents a problem because IP was originally developed with the assumption that devices would be connected to the network at fixed locations. As such, a device would be assigned a unique IP address, which would define the device's physical connection to the network. Since a mobile computing device is not permanently connected to the network at any single point, an IP address associated with the mobile computing device

5 does not define the device's physical connection to the network, thus violating an
important assumption of IP addresses. Various techniques have been developed for
mobility management as it relates to these mobile computing devices. One such
10 technique is described in U.S. Patent No. 5,159,592 which uses a nameserver and pseudo-
IP addresses to associate fixed names of mobile units with the pseudo-IP addresses. Even
though the pseudo-IP address may change, the current pseudo-IP address of a mobile unit
can be determined by looking up the fixed name in the nameserver. A technique called
15 tunneling is described in U.S. Patent No. 5,325,362 which uses special routers to store
current locations of mobile units in tables. When a router receives a packet for a mobile
unit, the packet is forwarded, or tunneled, to the appropriate current location. U.S. Patent
no. 5,708,655 describes the assignment of temporary IP addresses to mobile units such
20 that the mobile unit can provide the temporary IP address to another computer to
effectuate the transfer of data between that computer and the mobile unit. These
techniques provide some level of mobility management for mobile computing devices.

15 However, the above described techniques for mobility management for mobile
computing devices focus on the data communication functions of these devices.
25 However, it is noted that mobile computing devices can be configured with appropriate
hardware and software so that these devices can engage in voice communication via a
data network using IP. However, the techniques described above do not apply mobility
30 management techniques to mobile computing devices being used for IP voice
communication over data networks.

35 What is needed is an integrated mobility management solution for providing voice
calling services to mobile computing devices connected to a data network.

25 Summary of the Invention

40 In accordance with the invention, a telecommunication network node, referred to
as a service node, maintains status information for mobile computing device which are
authorized to connect to a data network and obtain services from the node. The
telecommunication network node manages voice calls placed to or from the mobile
45 computing devices. The status information includes registration information indicating
whether the mobile computing device is registered with the service node. The status

5 information may also include address information indicating a temporary address of a
visiting mobile computing device.

10 The mobile computing devices may engage in voice communication with other
mobile computing device or with telephones connected to the telephone network. If both
5 devices are mobile computing devices connected to the data network, the service node
established a voice call over the data network using a packet data protocol, such as
Internet Protocol (IP). The service node may monitor the call and provide additional
services such as conferencing.

15 The management of voice calls placed to or from the mobile computing device
10 includes determining whether a called mobile computing device is registered with the
system. If the mobile computing device is registered, the service node establishes a voice
path with the mobile computing device via the packet data network. If the mobile
20 computing device is not registered, the service node looks up a mobile identification
number associated with the mobile computing device and initiates a call to the wireless
15 telephone associated with the mobile identification number via a wireless communication
network.

25 In accordance with another aspect of the invention, the service node manages
voice calls between mobile computing devices connected to the data network via a packet
data protocol and telephones connected to the telephone network via a circuit switched
30 protocol. The service node acts as a gateway and translates between the packet data
20 protocol and the circuit switched protocol so that the users of the mobile computing
device and telephone can engage in a voice call.

35 In accordance with another aspect of the invention, a personal information
manager application executing on a mobile computing device controls call processing
25 preferences for the mobile computing device and associated wireless telephone.

40 These and other advantages of the invention will be apparent to those of ordinary
skill in the art by reference to the following detailed description and the accompanying
drawings.

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Brief Description of the Drawings

Fig. 1 shows a telecommunication network in which the present invention may be implemented;

Fig. 2 is a message flow diagram showing the messages and processing which occurs when a mobile computing device registers with the service node on the mobile computing device's home network;

Fig. 3 is a message flow diagram showing the messages and processing which occurs when a visiting mobile computing device registers with the service node;

Fig. 4 is a message flow diagram showing the messages and processing which occurs when a mobile computing device on the data network places a voice call to another mobile computing device on the data network;

Fig. 5 is a message flow diagram showing the messages and processing which occurs when a mobile computing device on the data network places a voice call to a non-registered mobile computing device on the data network;

Fig. 6 is a message flow diagram showing the messages and processing which occurs when an outside telephone places a call to a telephone number associated with a mobile computing device and the mobile computing device is registered with the service node;

Fig. 7 is a message flow diagram showing the messages and processing which occurs when an outside telephone places a call to a telephone number associated with a mobile computing device, the mobile computing device is not registered with the service node, and the wireless telephone associated with the mobile computing device is active;

Fig. 8 is a message flow diagram showing the messages and processing which occurs when an outside telephone places a call to a telephone number associated with a mobile computing device, the mobile computing device is not registered with the service node, and the wireless telephone associated with the mobile computing device is inactive; and

Fig. 9 is a message flow diagram showing the messages and processing which occurs when a mobile computing device originates a call to an outside telephone.

Detailed Description

Fig. 1 shows a telecommunication network in which the present invention may be implemented. A data network 102 includes local area networks (LAN) 140 and 142.

Connected to LAN 140 are mobile computing devices 104, 105, 106. Also connected to LAN 140 is LAN server 112. LAN 140 is connected to high speed network 124 via hub 116 and router 118. Connected to LAN 142 are mobile computing devices 107, 108, 109. Also connected to LAN 142 is LAN server 113. LAN 142 is connected high speed network 124 via hub 120 and router 122. In one embodiment of the invention, the mobile computing devices are laptop computers configured with the appropriate hardware and software to allow the computers to engage in voice communication via the data network using a data network protocol such as IP. The architecture and components of data networks, such as data network 102, are well known in the art and will not be discussed in detail herein.

Also shown in Fig. 1 is a wireless communication network 132 which includes a mobile switching center (MSC) 136 connected to a Home Location Register (HLR) 134, a radio base station (RBS) 146, and a voice mail node 137. A wireless telephone 148 is communicating with RBS 146 via a wireless communication link 150. The MSC 136 is typically connected to more than one RBS, where each RBS provides wireless communication to wireless telephones operating within the geographic area (i.e., cell) served by the RBS. The MSC 136 controls the functions of the RBSs connected to it. Only one RBS 146 is shown in Fig. 1 for clarity. The HLR 134 is used to store user profiles of subscribers to the wireless communication network 132. The MSC 136 is also connected to the public switched telephone network (PSTN) 138, which allows wireless telephones to communicate with wired telephones in the PSTN 138. The configuration and operation of a wireless communication network, such as network 132, is well known in the art and will not be described in further detail herein.

A service node 130 is connected to the data network 102, the wireless communication network 132, and HLR 134. The service node 130 performs the mobility management functions for providing voice calling services to mobile computing devices in accordance with the present invention. Service node 130 is an intelligent network

node which operates under control of a computer processor 160 executing computer program instructions. The service node 130 also includes memory 162 and database 164 for the storage of computer program instructions and other data.

Devices attached to the data network 102 are addressed using IP addresses. Thus, each device will have an IP address assigned to the device which uniquely identifies that device to the data network 102. The service node 130 is assigned a unique IP address on the data network 102 so that it may communicate with the other devices on the data network 102.

Nodes in the wireless communication network 132 are generally addressed using destination point codes which uniquely identify the nodes of the network. The service node 130 is assigned a unique destination point code on the wireless communication network 132 so that it may communicate with the other nodes on the wireless communication network 132.

The functioning of the service node 130 in accordance with the present invention will be described in connection with Figs. 2 - 9. The following description is organized into sections according to the call scenario. Each scenario will be described in conjunction with a message flow diagram. The message flow diagrams show the network components in boxes at the top of the diagram with each box having an associated vertical line below it. Messages flowing between the network components are shown as horizontal lines starting at the vertical line associated with the message source and ending at the vertical line associated with the message recipient. The relative timing of the messages is represented by earlier messages being at the top of the diagram with subsequent messages continuing down the diagram.

1. Mobile Computing Device Registration on Home Network

This section will describe the steps performed when a mobile computing device registers with the service node 130 on the mobile computing device's home network. A home network is defined as the network to which the mobile computing device most often connects. When connecting to the home network, a mobile computing device uses its permanent IP address which is stored in the memory of the mobile computing device. Fig. 2 is a message flow diagram showing the messages passed when a mobile computing

5 device registers with the service node 130 on the mobile computing device's home network. Assume that mobile computing device 104 is connected to LAN 140 as shown in Fig. 1, and that mobile computing device 104 is registering with the service node 130. As shown in Fig. 2, the first message 202 is a registration notification (RegNot) from the
10 5 mobile computing device 104 to the service node 130. The RegNot message 202 includes the permanent IP address of the mobile computing device 104.

It is noted that the database 164 of the service node 130 contains a profile of each mobile computing device which is authorized to connect to data network 102. This
15 10 profile includes the permanent IP address of the mobile computing device if the device has data network 102 as its home network. Therefore, when the service node 130 receives the IP address of mobile computing device 104 in message 202, the service node 130 recognizes mobile computing device 104 and allows it to register. If desired, the
20 15 RegNot message 202 could also include a password that would be known to the service node 130. In such an implementation, the correct password would be required before the service node 130 would register the mobile computing device.

25 Upon receipt of the RegNot message 202, the service node 130 stores information in database 164 indicating that mobile computing device 104 is registered. Service node then sends an acknowledgment (Ack) message 204 to the mobile computing device 104 acknowledging that the mobile computing device 104 is registered with the service node.
30 20

The registration process could be initiated in any of a number of ways. For example, registration could be initiated by an action by a user of a mobile computing device, such as a mouse click on an appropriate area of the screen. Alternatively,
35 25 registration with service node 130 could be automatic every time the computer is turned on and is connected to the data network.

2. Visiting Mobile Computing Device Registration on Network

40 Fig. 3 is a message flow diagram showing the messages passed when a visiting mobile computing device registers with the service node 130. Assume that visiting mobile computing device 107 has connected to LAN 142, but that LAN 142 is not the
45 30 home LAN of mobile computing device 107. Therefore, the mobile computing device 107 cannot use its permanent IP address while connected to LAN 142 because that IP

5 address will not be recognized by LAN 142. In order to register, mobile computing
device 107 sends a registration request (RegReq) message 302 to the router 122 on the
LAN 142. The RegReq includes an identification of the mobile computing device 107.
The router runs an application called a Dynamic Host Configuration Process which
10 5 receives the RegReq message 302 including the identification of the mobile computing
device 107 and assigns a temporary IP address to the mobile computing device 107. The
temporary IP address will be used only while the mobile computing device 107 remains
registered on LAN 142. The router 122 on LAN 142 returns the temporary IP address to
15 the mobile computing device 107 in message 304. Upon receipt of the temporary IP
20 address, the mobile computing device 107 sends a RegNot message 306 to the service
node 130. This RegNot message 306 includes the temporary IP address as well as an
identification of the mobile computing device 107.

Upon receipt of the RegNot message 306, the service node 130 checks the ID
received in message 306 against its list of authorized devices to determine whether to
15 register mobile computing device 107. If the mobile computing device 107 is authorized,
25 then the service node 130 stores information in database 164 indicating that mobile
computing device 107 is registered. Service node 130 then sends an acknowledgment
(Ack) message 308 to the mobile computing device 107 acknowledging that the mobile
computing device 107 is registered with the service node 130.

3. Mobile Computing Device Deregistration

20 In order for a mobile computing device to deregister with the service node 130,
35 the mobile computing device transmits a deregistration message to the service node 130.
The service node will then update its database to indicate that the mobile computing
25 device is no longer registered.

40 Deregistration could be initiated in any number of ways. For example,
deregistration could be initiated by an action by a user of a mobile computing device,
such as a mouse click on an appropriate area of the screen. Alternatively, deregistration
with service node 130 could be automatic every time the computer is turned off.

45 30 Further, deregistration could be initiated if the mobile computing device has been
idle for a predetermined period of time. In this case, the deregistration could be tied to a

screen saver, such that if the screen saver is activated, deregistration is initiated. Further,
when the screen saver is deactivated (for example when a user performs some activity),
re-registration could be automatically initiated.

4. Data network Call Between Registered Mobile Computing Devices

Fig. 4 is a message flow diagram indicating the messages and processing which occurs when a mobile computing device on the data network 102 places a voice call to another mobile computing device on the data network 102. Assume that mobile computing device 104 wants to place a voice call to mobile computing device 106. Also assume that both mobile computing device 104 and mobile computing device 106 are registered with the service node 130.

In order to initiate the call, mobile computing device 104 sends an origination request (OrigReq) message 402 to the service node 130. The OrigReq message 402 includes an identification of the calling mobile computing device 104, an identification of the called mobile computing device 106, and the type of call (e.g. voice). The identification of the mobile computing device may be the IP address, or may be some other identification which the service node 130 recognizes as being associated with a particular mobile computing device. Upon receipt of the OrigReq message 402, the service node 130 checks the status of the called device in step 403. In order to check the status, the service node 130 performs a database 164 lookup to determine whether the called mobile computing device is registered with the service node 130. In this case, the service node 130 will determine that mobile computing device 106 is registered with the service node 130 and the service node 130 will send an alert message 404 to the mobile computing device 106. The alert could result in an audio and/or visual indication on the mobile computing device 106 that there is an incoming call to the device. Further, the alert could also include an identification of the calling party or device. At this point, the service node 130 establishes a through connection (i.e., speech path) 410 between mobile computing device 104 and mobile computing device 106 by linking the call from mobile computing device 104 to mobile computing device 106. This is accomplished using the IP addresses of the devices. Assuming that the user of mobile computing device 106 wishes to answer the call, the user performs an appropriate function (e.g. a mouse click)

5 on the mobile computing device 106 which causes the mobile computing device 106 to
send an answer message 406 to the service node 130. Upon receipt of the answer
message 406, the service node 130 updates the status of the mobile computing devices
104 and 106 to indicated that they are engages in a call. Mobile computing device 106
10 5 and mobile computing device 104 may communicate via speech path 410.

It is noted that the mobile computing devices communicate voice information
using IP via LAN 140 which is a packet network. As such, the mobile computing devices
must contain appropriate software and hardware so that they can engage in a voice call
15 over the IP network. The transmission of voice over an IP network is well known in the
art. For example, VoxPhone™ Pro 3.0 is a product available from E-Tech Canada
10 Limited. VoxPhone™ is an IP telephony based PC application which performs calling
functions between mobile computing devices.
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The service node 130 monitors the progress of the call between mobile computing
device 104 and mobile computing device 106. Service node is able to monitor the call
15 because it knows the status of the mobile computing devices 104, 106 engages in the call.
When the status of a mobile computing device changes, updated information regarding
the new status is sent to the service node 130 from the mobile computing device via IP.
Thus, while the call is in progress, if another call comes in for one of the mobile
computing devices, the service node 130 will know that the mobile computing device is
30 20 currently engaged in a call. In such a situation, the mobile computing device could be
notified that another call has come in (similar to call waiting), or the new caller could be
notified that the called mobile computing device is busy and the new caller could
possibly leave a message with a voice mail system. Further, since the service node 130
35 monitors the call, the service node 130 could provide other services, such as
25 conferencing, three way calling, call forwarding, incoming call screening, outgoing call
restrictions, short message service (SMS text to phone), message waiting indicator
40 (MWI), and information services (e.g. stock quotes, meeting reminders, etc.).

5. Data Network Call From A Registered Mobile Computing Device To A Non-Registered Mobile Computing Device

Fig. 5 is a message flow diagram indicating the messages and processing which occurs when a mobile computing device on the data network 102 places a voice call to a non-registered mobile computing device on the data network 102. Assume that mobile computing device 104 wants to place a voice call to mobile computing device 106. Also assume that mobile computing device 104 is registered with the service node 130 but mobile computing device 106 is not registered with the service node 130.

In order to initiate the call, mobile computing device 104 sends an origination request (OrigReq) message 502 to the service node 130. This OrigReq message 502 is the same as message 402 described above in conjunction with Fig. 4. Upon receipt of the OrigReq message 502, the service node 130 checks the status of the called device in step 504 by performing a database 164 lookup to determine whether the called mobile computing device 106 is registered with the service node 130. In this case, the service node 130 will determine that mobile computing device 106 is not registered with the service node 130. Service node 130 will then attempt to connect the call from mobile computing device 104 to a wireless telephone associated with mobile computing device 106 as follows.

Service node 130 performs a database 164 lookup to determine a mobile identification number (MIN) associated with mobile computing device 106. As described above, the service node 130 stores information relating to each mobile computing device authorized to obtain service from the service node 130. Included in that information is a MIN associated with the mobile computing device. In addition, as is well known in wireless communications, every MIN is associated with a particular HLR. A range of MINs will be associated with a particular HLR. The service node 130 stores a lookup table in database 164 which associates MINs with their HLR. Thus, upon determining the MIN, the service node 130 performs another database 164 lookup to determine the HLR associated with that MIN. Upon determining the MIN and associated HLR, the service node 130 sends a location request (LocReq) message 506 to HLR 134 in the wireless communication network. The LocReq message 506 includes the MIN.

5 The HLR 134 stores a profile for each MIN associated with the HLR 134. This
profile includes an indication of whether the wireless telephone having the particular
MIN is registered with the wireless network, and if so, the identification of the current
serving MSC. Thus, upon receipt of the message 506, the HLR 134 determines the
10 5 currently serving MSC and sends a route request (RouteReq) message 508 to that serving
MSC. The serving MSC, upon receipt of message 508, assigns a temporary location
directory number (TLDN) for the call to the wireless telephone associated with the MIN.
The serving MSC returns the assigned TLDN to the HLR 134 in RouteReq message 510.
15 The HLR 134 then transmits the TLDN to the service node 130 in LocReq message 512.

20 It is noted that messages 506, 508, 510, 512 are IS-41 message. IS-41 is a
telecommunications standard protocol which provides messages in support of mobility
management. IS-41 is described in further detail in, *TIA / EIA / IS-41 Cellular
Radiotelecommunications Intersystem Operations, Revision C.*

25 Upon receipt of the TLDN, the service node 130 seizes a time slot on MSC 136
using Integrated Services Digital Network User Part (ISUP) message 514. ISUP is part
of the Signaling System No. 7 (SS7) protocol and is used for providing call control
signaling functions and is well known in the art of telecommunications. The seized time
slot will be used for communication with the wireless telephone. Service node 130 also
30 sends an ISUP call request message 516 to the MSC 136 requesting that the MSC 136
place a call to the TLDN. The MSC 136 places the call to the TLDN using ISUP
message 518, and the call is routed to the serving MSC and the serving MSC alerts the
wireless telephone of the incoming call. If the wireless telephone answers, then the
35 serving MSC sends an answer message 520 to the MSC 136. Thereafter, two speech
paths are in place. Speech path 522 between the service node 130 and the MSC 136 is a
circuit switched speech path. Speech path 524 between mobile computing device 104
25 and service node 130 is a packet data speech path. Thus, in order for a user of mobile
computing device 104 to engage in a voice call with the wireless telephone, the service
node 130 must translate between the circuit switched protocol and the packet data
protocol, thus bridging speech path 524 and speech path 522. Techniques used to bridge
40 standard voice (circuit switched) traffic with IP data is well known in the art and
described in the International Telecommunications Union (ITU), Specification H.323,

Visual Telephone Systems and Equipment for Local Area Networks Which Provide a Non-Guaranteed Quality of Service - Series H: Audiovisual and Multimedia Systems Infrastructure of Audiovisual Services - Systems and Terminal Equipment for Audiovisual Services Study Group 15.

6. Call To Data network Computing Device From An Outside Device When Computing Device is Registered

Fig. 6 is a message flow diagram indicating the messages and processing which occurs when an outside telephone places a call to a telephone number associated with a mobile computing device and the mobile computing device is registered with the service node 130. It is noted that this telephone number could be associated with the mobile computing device an/or a wireless telephone. Assume for purposes of this example that the telephone number dialed by the outside telephone is a MIN associated with a wireless telephone in the wireless telephone network. However, if the user of the telephone assigned that MIN is also a user of data network 102 and service node 103, then that user could have all calls placed to the MIN first be connected to the user's mobile computing device if the user's mobile computing device is registered with the service node 130. Such processing proceeds as follows.

Assume that an outside telephone places a call to a MIN associated with a user's wireless telephone. The call will be routed to the wireless telephone's home MSC 136. As is standard wireless telephone call processing, the MSC 136 sends a LocReq message 602 including the dialed MIN to the HLR 134 in order to determine the current location of the wireless telephone. However, since user of the wireless telephone is also a user of data network 102 and service node 130, the user has set up his/her user profile in HLR 134 to indicate that any calls to the MIN first be attempted to be connected via the data network 102. As such, upon receipt of message 602, the HLR 134 sends a service request message 604, including the MIN and type, to the service node 130. Upon receipt of the service request message 604, the service node 130 performs a database 164 lookup to determine the identification of the mobile computing device associated with the received MIN. Such an identification will advantageously be the IP address of the mobile computing device. Upon determining the associated mobile computing device,

the service node 130 checks the status of the mobile computing device in step 606 by performing a database 164 lookup to determine whether the called mobile computing device is registered with the service node 130. In this case, the service node 130 will determine that mobile computing device 106 is registered with the service node 130.

The service node 130 will then select a TLDN from a pool of TLDNs associated with the service node and will send the TLDN to the HLR in service request message 608. Upon receipt of the TLDN, the HLR sends the TLDN to the MSC 136 in LocReq message 610. Upon receipt of the TLDN, the MSC 136 places a call to the TLDN using ISUP message 612, and the call is routed to the service node 130. Upon receipt of the call, the service node alerts the mobile computing device 104 in message 614. If the user of mobile computing device 104 answers the call, the mobile computing device 104 sends an answer message 616 to the service node 130. Upon receipt of the answer message 616, the service node 130 sends an answer message 618 to MSC 136. Thereafter, the MSC 136 connects the call to speech path 620 which is a circuit switched speech path between the service node 130 and the MSC 136. Similarly, a speech path 622 exists between mobile computing device 104 and service node 130. Speech path 622 is a data packet speech path. As described above, in order for a user of mobile computing device 104 to engage in a voice call with the calling telephone, the service node 130 must translate between the circuit switched protocol and the packet data protocol, thus bridging speech path 620 and speech path 622.

7. Call To Data network Computing Device From An Outside Device When Computing Device Is Not Registered and Wireless Telephone Active

Fig. 7 is a message flow diagram indicating the messages and processing which occurs when an outside telephone places a call to a telephone number associated with a mobile computing device, the mobile computing device is not registered with the service node 130, and the wireless telephone associated with the mobile computing device is active. Assume that an outside telephone places a call to a MIN associated with a user's wireless telephone. The call will be routed to the wireless telephone's home MSC 136. As is standard wireless telephone call processing, the MSC 136 sends a LocReq message 702 including the dialed MIN to the HLR 134 in order to determine the current location

5 of the wireless telephone. However, since user of the wireless telephone is also a user of
data network 102 and service node 130, the user has set up his/her user profile in HLR
134 to indicate that any calls to the MIN first be attempted to be connected via the data
network 102. As such, upon receipt of message 702, the HLR 134 sends a service
10 request message 704, including the MIN and type, to the service node 130. Upon receipt
of the service request message 704, the service node 130 performs a database 164 lookup
to determine the identification of the mobile computing device associated with the
received MIN. Upon determining the associated mobile computing device, the service
15 node 130 checks the status of the mobile computing device in step 706 by performing a
database 164 lookup to determine whether the called mobile computing device is
registered with the service node 130. In this case, the service node 130 will determine
that the mobile computing device is not registered with the service node 130. Thus, the
20 service node 130 will return a service request message 708 indicating that the HLR 134
should continue processing in a manner consistent with normal cellular call processing.

15 The HLR 134 looks up the profile of the dialed MIN to determine the current
serving MSC for the wireless telephone. The HLR 134 then sends a RouteReq message
25 710, including the MIN, to the current serving MSC. The serving MSC responds with a
RouteReq message 712 including a TLDN. The HLR 134 forwards the TLDN to the
home MSC 136 in LocReq message 714. Upon receipt of the TLDN, the MSC 136
30 places a call to the TLDN using ISUP message 716, and the call is routed to the serving
MSC. At this point, the call is completed from the calling telephone to the wireless
telephone in a conventional manner.

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25 8. Call To Data network Computing Device From An Outside Device When
Computing Device Is Not Registered and Wireless Telephone Inactive

40 Fig. 8 is a message flow diagram indicating the messages and processing which
occurs when an outside telephone places a call to a telephone number associated with a
mobile computing device, the mobile computing device is not registered with the service
30 node 130, and the wireless telephone associated with the mobile computing device is
inactive. Assume that an outside telephone places a call to a MIN associated with a
45 user's wireless telephone. The call will be routed to the wireless telephone's home MSC

5 136. As is standard wireless telephone call processing, the MSC 136 sends a LocReq
message 802 including the dialed MIN to the HLR 134 in order to determine the current
location of the wireless telephone. However, since user of the wireless telephone is also
10 a user of data network 102 and service node 130, the user has set up his/her user profile
5 in HLR 134 to indicate that any calls to the MIN first be attempted to be connected via
the data network 102. As such, upon receipt of message 802, the HLR 134 sends a
service request message 804, including the MIN and type, to the service node 130. Upon
15 receipt of the service request message 804, the service node 130 performs a database 164
lookup to determine the identification of the mobile computing device associated with the
10 received MIN. Upon determining the associated mobile computing device, the service
node 130 checks the status of the mobile computing device in step 806 by performing a
20 database 164 lookup to determine whether the called mobile computing device is
registered with the service node 130. In this case, the service node 130 will determine
that mobile computing device 106 is not registered with the service node 130. Thus, the
15 service node 130 will return a service request message 808 indicating that the HLR 134
should continue processing in a manner consistent with normal cellular call processing.

The HLR 134 looks up the profile of the dialed MIN to determine the current
serving MSC for the wireless telephone. In this example, the HLR 134 determines that
30 the wireless telephone is not registered with the wireless communication network. Thus,
20 the HLR 134 then sends a LocReq message 810 to the home MSC 136 indicating voice
mail node 137. Upon receipt of the message 810, the MSC 136 routes the call to voice
mail node 137 using ISUP message 812.

9. Data network Computing Device Originates Call to Outside Telephone

25 Fig. 9 is a message flow diagram indicating the messages and processing which
occurs when a mobile computing device originates a call to an outside telephone. The
40 mobile computing device 104 initiates the call by sending an origination request message
902, including the dialed digits, to the service node 130. Using ISUP, the service node
45 130 assigns a circuit and sends the dialed digits to the MSC 136 in message 904. The
MSC 136 accepts the dialed digits as if this was a telephone call being initiated by a

5 wireless telephone. The MSC 136 sets up the call by sending an ISUP message 906 to
the PSTN 138 in a conventional manner. The telephone associated with the dialed digits
is alerted using alert message 908 and when the telephone answers the call an answer
message 910 is returned to the PSTN 138. In this manner, a circuit switched voice path
10 912 is set up between the service node 130 and the telephone, and a packet data voice
path 914 is set up between the mobile computing device 104 and the service node 130.
As described above, in order for a user of mobile computing device 104 to engage in a
voice call with the called telephone, the service node 130 must translate between the
15 circuit switched protocol and the packet data protocol, thus bridging speech path 912 and
speech path 914.

20 10. Call Management Using Personal Information Manager

In accordance with another aspect of the invention, call processing may be based
15 on information stored in a mobile computing device in connection with a personal
information manager (PIM) application which is executing on the mobile computing
device. As is well known, a PIM is a software application which executes on a computer
25 and which is used for managing personal information of a user. For example, such
personal information may include schedule data (e.g. meeting times) and contact data
(e.g. telephone and address information).

In accordance with one aspect of the invention, information stored in the PIM can
also be used for call processing management purposes. For example, consider a user
35 using mobile computing device 104. If mobile computing device 104 is executing a PIM,
the user of mobile computing device 104 will have schedule information stored on the
PIM. Assume that one of the items stored in the PIM indicates that the user has a
25 meeting scheduled for June 1 at 2PM to 4PM. The PIM may be linked to the call
processing software of the mobile computing device so that if a call comes in to the
mobile computing device, the PIM information will be used to make call processing
40 decisions. For example, assume that the user of mobile computing device 104 has
indicated in the PIM that the meeting from 2PM to 4PM is very important, and that all
30 calls coming in to the mobile computing device between 2PM and 4PM are to be routed

5 to voice mail. If a call comes in to the mobile computing device during the meeting time,
the mobile computing device 104 will send an appropriate message to the service node
130 indicating that the user is not accepting calls. The service node 130 will recognize
the message from the mobile computing device 104 and will route the call to voice mail.

10 5 In addition to schedule information, contact PIM information may be used for call
processing by linking contact information (including name and telephone number) to
selective call acceptance functions of the mobile computing device. For example, a user
of a mobile computing device can indicate that only calls from particular telephone
15 numbers will be accepted, or that calls from particular telephone numbers will always be
rejected. The user can set up these calling functions using the names and associated
20 telephone numbers stored in the PIM.

Thus, in accordance with the PIM processing aspects of the invention, certain
PIM functions are linked to specific calling patterns, thus scheduling time and
communications in the same way.

15 25 The foregoing Detailed Description is to be understood as being in every respect
illustrative and exemplary, but not restrictive, and the scope of the invention disclosed
herein is not to be determined from the Detailed Description, but rather from the claims
as interpreted according to the full breadth permitted by the patent laws. It is to be
understood that the embodiments shown and described herein are only illustrative of the
30 principles of the present invention and that various modifications may be implemented by
those skilled in the art without departing from the scope and spirit of the invention. For
example, although the invention is described in conjunction with a data network
consisting of connected LANs, the principles of the present invention could be
35 implemented utilizing any type of data network. For example, the mobile computing
25 devices could utilize cable modems to connect to a cable television network which is
used, at least in part, as a data network. Further, the data network could be the Internet,
40 or some other public data network.

Claims

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We claim:

- 1 1. A method of operation of a telecommunications network node, said
2 telecommunications network node connected to a data network and to a wireless
3 telephone network, the method comprising the steps of:
4 maintaining status information for a plurality of mobile computing devices which
5 are authorized to connect to said data network and obtain service from said
6 telecommunications network node; and
7 managing voice calls placed to or from said mobile computing devices.
- 1 2. The method of claim 1 further comprising the steps of:
2 receiving a request to initiate a voice call to a first mobile computing device from
3 a second mobile computing device;
4 determining that said first mobile computing device is registered with said data
5 network; and
6 initiating a voice call from said second mobile computing device to said first
7 mobile computing device via said data network using a packet data protocol.
- 1 3. The method of claim 1 further comprising the steps of:
2 receiving a voice call placed to a first mobile computing device from a second
3 mobile computing device;
4 determining that said first mobile computing device is not registered with said
5 data network;
6 performing a database access to retrieve a mobile telephone identification number
7 associated with said first mobile computing device; and
8 initiating a voice call between said second mobile computing device and a mobile
9 telephone associate with said mobile telephone identification number via the data
10 network and the wireless telephone network.

5 1 4. The method of claim 3 wherein said second mobile computing device
2 communicates via packet data protocol and said mobile telephone communicates via
3 circuit switched protocol, said method further comprising the step of:
4 translating between said packet data protocol and said circuit switched protocol.

10 1 5. The method of claim 1 further comprising the steps of:
2 receiving a service request including a mobile telephone identification number
3 from said wireless telephone network;
15 4 performing a database access to retrieve an identification of a mobile computing
5 device associated with said mobile telephone identification number; and
6 determining whether said mobile computing device associated with said mobile
20 7 telephone identification number is registered with said data network.

1 6. The method of claim 5 wherein said step of determining results in a
2 determination that said mobile computing device associated with said mobile telephone
25 3 identification number is registered with said data network, the method further comprising
4 the steps of:
5 assigning a TLDN and transmitting said TLDN to said wireless telephone
30 6 network;
7 receiving a call from said wireless telephone network via said TLDN; and
8 establishing a speech path between said call and said mobile computing device.

35 1 7. The method of claim 6 wherein said mobile computing device communicates
2 via packet data protocol and the call received from said wireless telephone network uses a
3 circuit switched protocol, said method further comprising the step of:
40 4 translating between said packet data protocol and said circuit switched protocol.

1 8. The method of claim 5 wherein said step of determining results in a
2 determination that said mobile computing device associated with said mobile telephone
45 3 identification number is not registered with said data network, the method further
4 comprising the step of:

5 transmitting an indication that said mobile computing device is not available to
6 said wireless telephone network.

1 9. The method of claim 5 wherein said step of determining results in a
10 2 determination that said mobile computing device associated with said mobile telephone
3 identification number is not registered with said data network, the method further
4 comprising the step of:
5 transmitting routing information specifying a voice mail system to said public
15 6 wireless telephone network.

1 10. The method of claim 1 further comprising the steps of:
20 2 receiving a request to initiate a voice call to a telephone outside of said first data
3 network from a mobile computing device; and
4 initiating a voice call between said mobile computing device and said telephone
5 via the wireless telephone network.
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1 11. The method of claim 10 wherein said mobile computing device
2 communicates via packet data protocol and said telephone communicates via circuit
30 3 switched protocol, said method further comprising the step of:
4 translating between said packet data protocol and said circuit switched protocol.

1 12. The method of claim 1 wherein said step of maintaining status information
35 2 further comprises the steps of:
3 receiving a registration request from a mobile computing device, said registration
4 request including an address of said mobile computing device on said data network.

40 1 13. The method of claim 12 wherein said address is a temporary address assigned
2 by said data network.

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1 14. The method of claim 1 wherein said step of managing voice calls further
2 comprises the step of receiving call processing instructions from a personal information
3 manager application executing on a mobile computing device.

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1 15. The method of claim 1 wherein said step of maintaining status information
2 further comprises the step of:
3 receiving a deregistration message from a mobile computing device when a
4 screen saver executing on said mobile computing device is activated; and
15 5 receiving a registration message from a mobile computing device when a screen
6 saver executing on said mobile computing device is deactivated.

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1 16. A telecommunications network node for managing voice calls to and from
2 mobile computing devices, said network node comprising:
3 a database for storing location and status information for a plurality of mobile
4 computing devices connected to a data network;
25 5 a first communication port for connecting to said data network using a packet data
6 protocol;
7 a second communication port for connecting to a telephone network using a
30 8 circuit switched protocol; and
9 means for managing voice communications between said mobile computing
10 devices and telephones connected to said telephone network.

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1 17. The telecommunications network node of claim 16 wherein said means for
2 managing voice communications further comprises:
3 means for translating between said packet data protocol and said circuit switched
40 4 protocol.

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1 18. The telecommunications network node of claim 16 wherein said database
2 further stores a mobile identification number associated with said mobile computing
3 devices.

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1 19. The telecommunications network node of claim 18 wherein said database
2 further stores a temporary data network address for a visiting mobile computing device.

1 20. The telecommunications network node of claim 16 wherein said means for
2 managing voice communications further comprises:

3 means for receiving call processing instructions from a personal information
4 manager application executing on a mobile computing device.

1 21. A telecommunications network node connected to a data network and to a
2 telephone network for managing voice calls to and from mobile computing devices
3 connected to said data network, said telecommunications network node comprising:

4 a storage device for storing status information for a plurality of said mobile
5 computing devices;

6 means for receiving a request to establish a voice call with one of said mobile
7 computing devices; and

8 means for establishing said voice call with said one mobile computing device.

1 22. The telecommunications network node of claim 21 wherein said request to
2 establish a voice call comprises a mobile identification number of a wireless telephone
3 and wherein said storage device further stores a mobile identification number associated
4 with said mobile computing devices, said telecommunications network node further
5 comprising:

6 means for accessing said storage device to determine the mobile computing
7 device associated with the mobile identification number received in said request to
8 establish a voice call.

1 23. The telecommunications network node of claim 21 wherein said voice call is
2 between a telephone connected to said telephone network via a circuit switched protocol
3 and said mobile computing device connected to said data network via a packet data
4 protocol, said telecommunications network node further comprising:

5 means for translating between said circuit switched protocol and said packet data
6 protocol.

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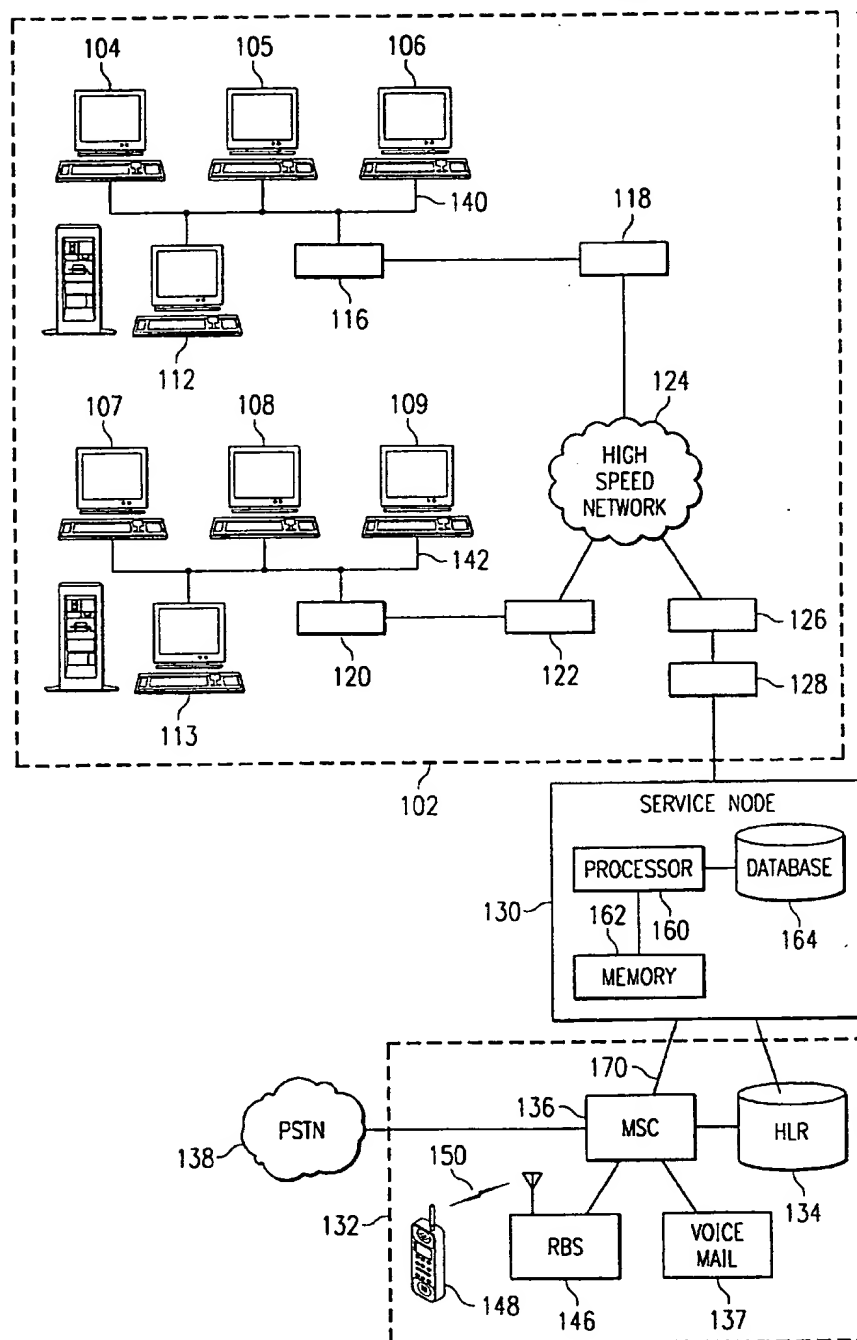
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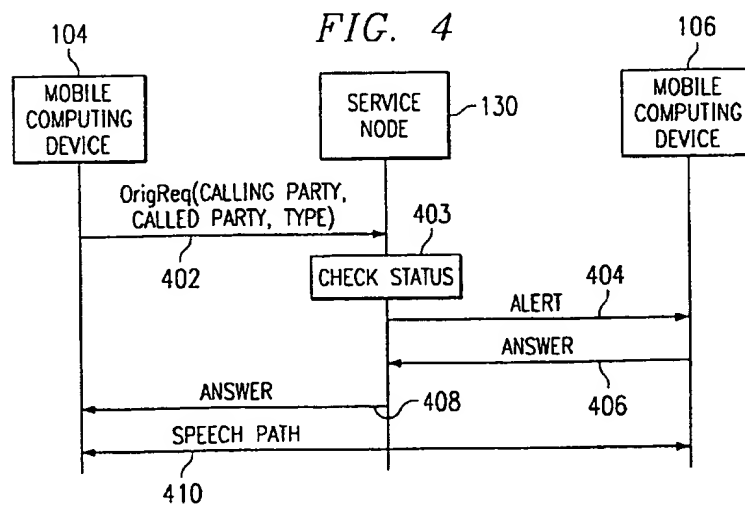
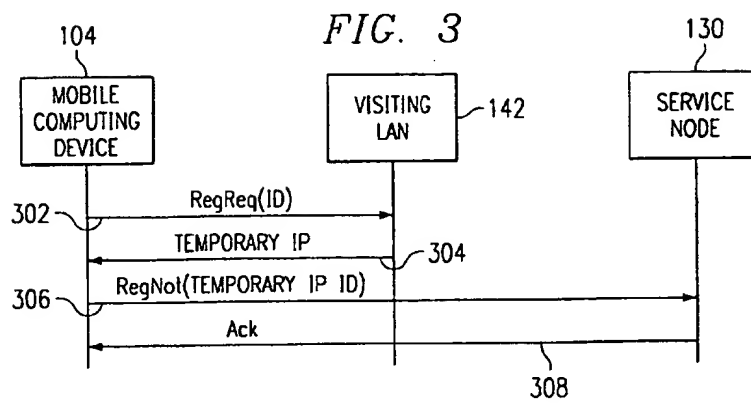
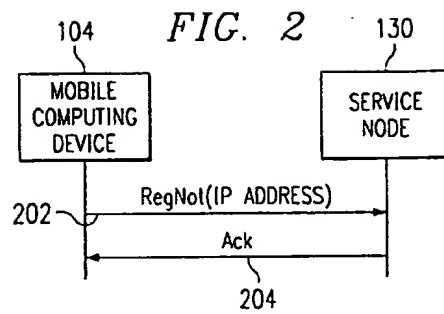
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FIG. 1

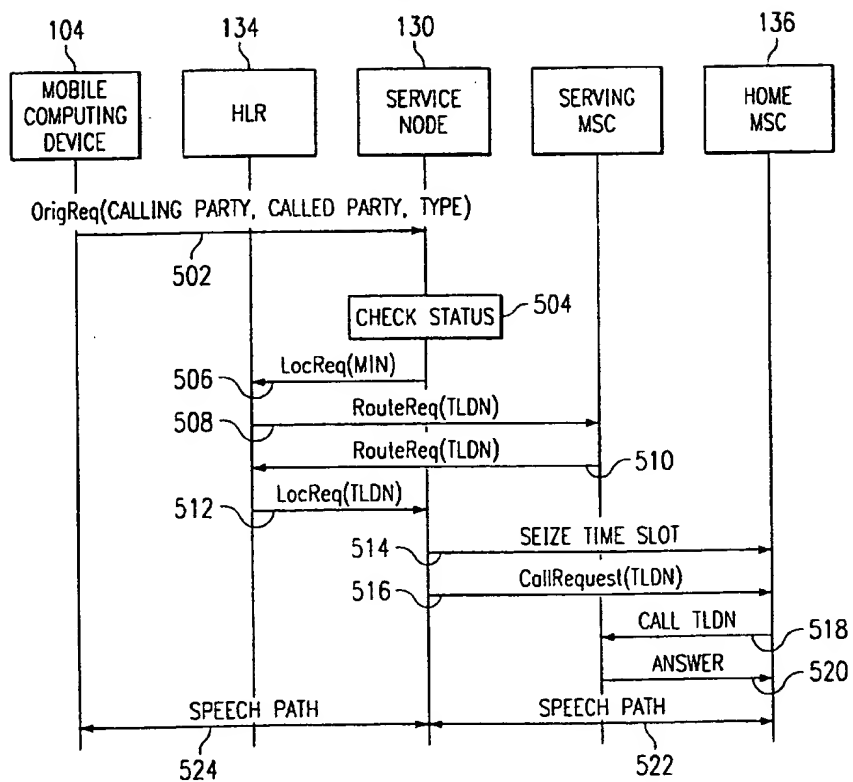


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FIG. 5



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FIG. 6

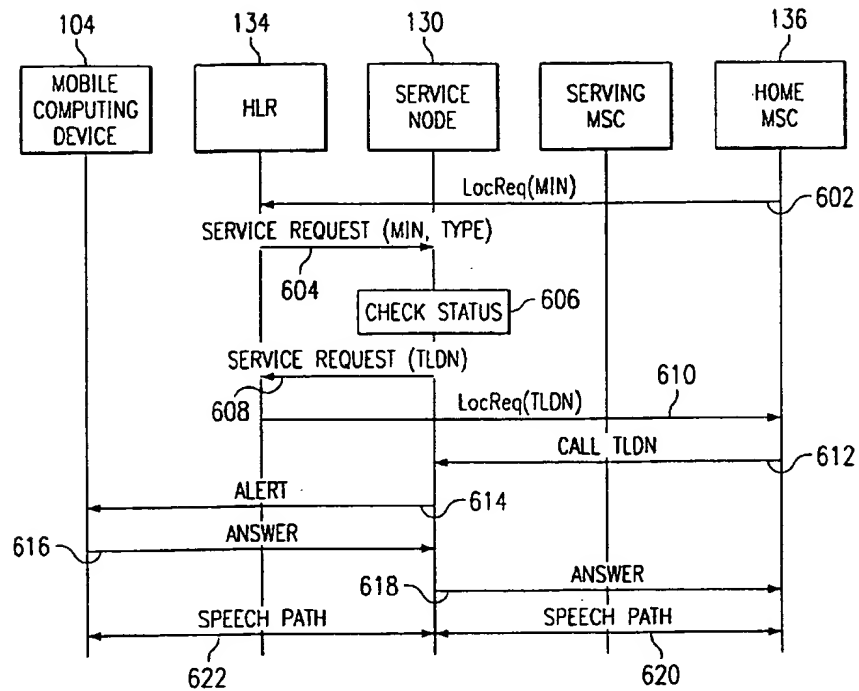
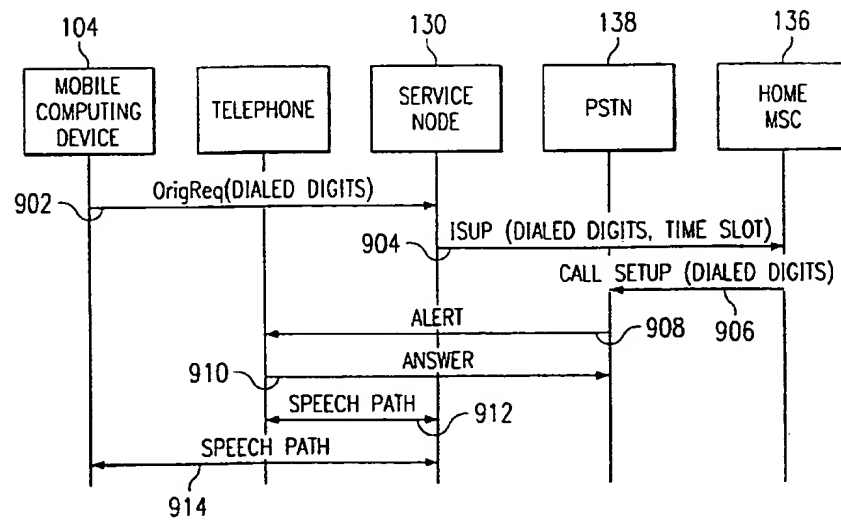


FIG. 9



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FIG. 7

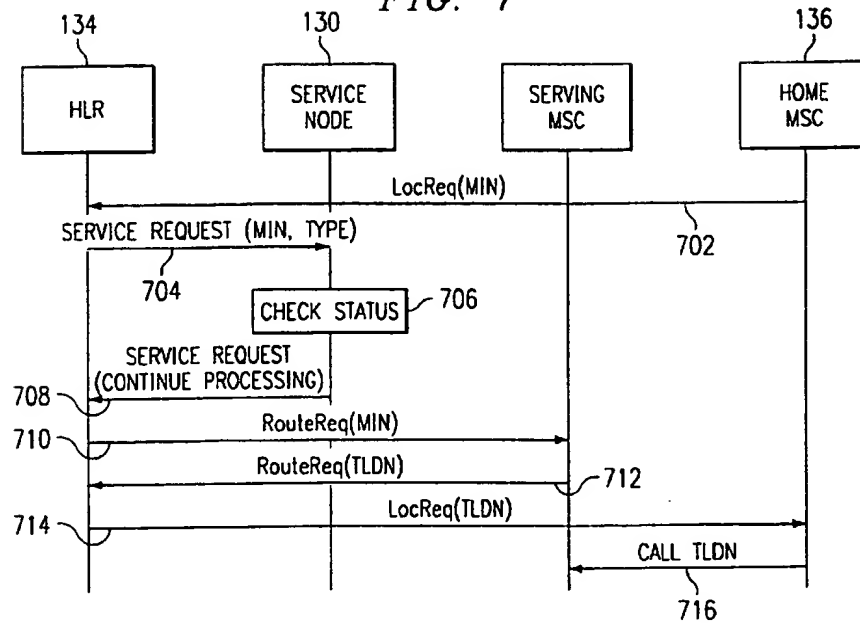


FIG. 8

